DOCUMENT RESUME

ED 346 134 TM 018 431

AUTHOR Thorndike, Robert M.; Andrieu-Parker, Jacqueline M.

TITLE Growth in Knowledge: A Two-Year Longitudinal Study of Changes in Scores on the College Basic Academic Subjects Examination.

PUB DATE 92
NOTE 20p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement; *Achievement Gains; Achievement Tests; *Cognitive Processes; *College Outcomes Assessment; College Students; Comparative Testing; Higher Education; Knowledge Level; Longitudinal Studies; *Pretests Posttests; *Scores; Skill Development
IDENTIFIERS College Basic Academic Subjects Examination; Test Retest Reliability

ABSTRACT

Cognitive changes in college students from early in the freshman year to the end of the sophomore year were assessed using a pretest-posttest design. In all, 135 university students completed both a pretest and a posttest. The academic achievement measure used was the College Basic Academic Subjects Examination (CBASE), a test intended to assess content knowledge and skill development at a level with students completing the general education component of their college experience. The analysis of pretest and posttest scores showed a general average gain of about one-quarter of a standard deviation, but there were some notable losses, with some students losing almost 200 scale points on retesting while others showed large gains. Results indicate that the CBASE is a high quality instrument with good test-retest reliability, but that it adds little to information about entering students that is available from other sources. CBASE scores indicated growth in almost all areas. The large losses demonstrated by some students may be explained by the fact that they did not take the test seriously, attempting only to complete the task in the minimum time possible. Eleven tables present study data, and there is a seven-item list of references. (SLD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED346134

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

ROBERT M. THORNDIKE

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

GROWTH IN KNOWLEDGE: A TWO-YEAR LONGITUDINAL STUDY OF CHANGES IN SCORES ON THE COLLEGE BASIC ACADEMIC SUBJECTS EXAMINATION

Robert M. Thorndike
Jacqueline M. Andrieu-Parker
Western Washington University

TM018431

BEST COPY AVAILABLE

Growth in knowledge:

A two-year longitudinal study of changes in scores on the College Basic Academic Subjects Examination

Robert M. Thorndike and

Jacqueline M. Andrieu-Parker

Western Washington University

The assessment of cognitive changes that occur as a result of higher education has been a growing concern among college and universities since Astin (1985) and others brought the issue of outcomes assessment to public attention. Banta and Fisher (1987) delineated the issues and problems of assessment, particularly at the state level.

Three major test publishers have provided standardized instruments to measure higher education outcomes. Numerous studies using these instruments have been conducted, particularly by Banta, Pike and their associates in Tennessee. A large statewide study also was conducted in Washington (Council of Presidents, 1989).

The focus of higher education outcomes assessment is on changes that can be attributed to the educational treatments encountered by students as part of their higher education. However, most of the studies reported to date have either used no pretreatment measure at all or have used a cognitive level estimated by an academic admissions test (SAT or ACT). The hazards of this practice have been described by Banta, Lambert, Pike, Schmidhammer, and Schneider (1987), in the Council of Presidents (1989) report, and in studies by Parker and Thorndike (1989) and Thorndike, Andrieu-Parker, and Kube (1990).

The present study attacked the problem of changes in test performance over the first two years of college experience directly by using a pretest-posttest design. Since most concerns about outcomes assessment have focused on general education achievement rather than on learning in the major, the objective of this study was to assess cognitive changes from early in the first term of freshman year to the end of the last term of sophomore year, the period during which most students concentrate on general education courses.

Method

Subjects.. Subjects were obtained by drawing a random sample of 300 from the pool all first-term freshmen (about 1500) enrolled in the university in October of 1988. These students were invited to participate in the study and were offered $35 for doing so. Two hundred one (201) individuals appeared for

TM018431

testing, and 197 completed the tests. In May of 1990 190 of the 197 original participants were still enrolled at the university. Letters were sent to all of these students offering them $50 to take part in the posttest. Of these, 135 responded.

Instrument. The academic achievement measure used was the College Basic Academic Subjects Examination (CBASE). "College BASE is intended to assess content knowledge and skill development at a level commensurate with students completing the general education component of their college experience. At most institutions this will be near the end of the sophomore year." (Osterlind, 1989, p. 1). The instrument tests knowledge in four subjects (English, Mathematics, Science, and Social Studies), which are further subdivided into nine clusters of 23 skills. A composite score representing overall competence and three reasoning competencies are also computed. The objective portion of the test has a three hour time limit, and most students finish within the time allowed. Scores are determined using an IRT model and are converted to a scale with a mean of 300 and SD of 60. Criterion referenced scores in the three reasoning competencies (interpretive, strategic, and adaptive) are reported as high, middle, and low.

Procedure. At the pretest all subjects took the complete CBASE, including a writing sample. Each subject also filled out a questionnaire on reasons for attending college, views of education, and living arrangements. In addition, half of the sample completed the Reading and Math sections of the Collegiate Assessment of Academic Proficiency (CAAP) while the other half completed the Writing and Critical Thinking sections of this instrument. Testing took six hours. In addition, college admissions test scores on the Washington Precollege Test (WPCT) were obtained from university admissions records. At the posttest each subject again took the CBASE and the two CAAP subtests that they had taken 18 months earlier. The writing sample and questionnaire were omitted. The posttest took five hours. Only the portion of the study dealing with the CBASE and its relationship to background and demographic variables is reported here. A list of all variables together with the abbreviations used in the tables is provided in Table 1.

Table 1 about here

Results

The complete pretest group (N=197) received a mean composite score of 299 with an SD of 49.5. The mean pretest composite score for the 135 students who also took the posttest was 304 with an SD of 48.7, indicating that the returning students were slightly superior to those who did not return for retesting. Table 2 shows the mean pretest score, mean posttest score, mean raw change and standard deviation of raw change for the four subject scores and the 9 clusters for the 135 subjects who

participated in both testing sessions. All analyses were carried out on this group.

Table 2 about here

The pattern shown here is one of general gain averaging about 1/4 standard deviation, but with some notable losses. What is striking about the changes is the size of the standard deviations. Some subjects lost almost 200 scale points on retesting while others showed relatively large gains. There were no significant differences between men and women in the amount of gain, but there were some differences at each test occasion. None of the CBASE variables were significantly related to any of nonacademic background variables, so these variables will not be mentioned further.

The correlations among the pretest scores for the CBASE Subjects and Clusters are presented in Table 3. This table shows the pattern of generally high positive correlations that one would expect to find among measures of academic ability or achievement. The noteworthy feature of this table is the generally low correlations of the Writing cluster scores with the Social Sciences scales and the low correlations of the Algebra cluster scores with both the Science and Social Studies scales.

Table 3 about here

Table 4 presents the correlations among the posttest scores for the CBASE scales. These correlations are quite similar to those in Table 3. In particular, the Algebra cluster continued its low correlations with Science and Social Studies, but the correlations of Writing with the non-English scores dropped. The impression continues that scores are determined primarily by a general academic ability dimension.

Table 4 about here

The correlations of scores on the pretest with scores from the posttest are shown in Table 5. This table is of particular interest because the diagonal values are the 18-month test-retest reliabilities of the CBASE Subject and Cluster scores. The values run from a high of 0.85 for the Composite score to a low of 0.43 for the Algebra cluster score. The lowest subject area reliability is 0.67 for the Science area. Pretest Algebra does not correlate highly with the Posttest Science or Social Studies scales, and posttest algebra does not correlate significantly with much outside the Mathematics area, but the impression continues to be one of a single broad general academic ability.

Table 5 about here

The correlations of Pretest and Posttest CBASE scores with high school Grade-Point Average, University Grade-Point Average, and admissions test scores with are presented in Tables 6 and 7. As one would expect, all of the correlations are positive, but many of them are surprisingly high.

Tables 6 and 7 about here

Two features are quite striking in these tables. First, the Washington Precollege Test scores correlate more highly with CBASE scores than do either high school or college grades. Since in most cases the Washington Precollege Test was taken at the end of sophomore or beginning of junior year in high school, the average interval between these test scores and the CBASE pretest is about two years and the average interval with the posttest CBASE is about 42 months. The intervals between the CBASE and grades is much shorter. The high correlations of CBASE with WPCT over such a long time interval indicate a substantial equivalence between the CBASE and some aspects of the WPCT.

The second striking feature is that, for the Verbal Composite (WPCT2) and the Quantitative Composite (WPCT3), the correlations with the verbal (English) and quantitative (Mathematics) sections of the CBASE are about as high as the test-retest correlations, even though the time interval is twice as long.

Tables 8 and 9 present the correlations of raw change scores on the CBASE with the pretest and posttest scores. What these tables reveal is the expected pattern of negative correlations of gains with pretest scores and positive correlations of gains with posttest scores. That is, people who start out above average tend to show less growth than people who start out below average, and people who show larger amounts of growth tend to achieve higher posttest scores than people who show small or negative growth. The other noteworthy feature of these tables is specificity of the relationships. Very few significant correlations occur outside a particular subject matter. For example, only two of the correlations of English subject or cluster gain scores with gain scores from other areas reach 0.20. Of course, this observation does not hold with the part-whole relationships with competencies or the composite score.

Tables 8 and 9 about here

To explore the structure and the stability of structure of

the CBASE, the pretest and posttest clusters were factor analyzed together. That is, the nine pretest clusters were combined with the nine posttest clusters and the resulting 18x18 correlation matrix was factor analyzed using principal axis extraction with squared multiple correlations as initial communality estimates and iterating for the communalities with four factors. The resulting factor matrix was rotated by oblimin. The eigenvalues and SMCs are presented in Table 10, and the oblique pattern matrix and final communalities are given in Table 11.

Tables 10 and 11 about here

Both the Kaiser/Guttman criterion and the scree test clearly indicate four factors; however, both the SMCs and eigenvalues are probably inflated by virtue of including pretest and posttest variables in the same matrix. Because the design of the instrument also called for four factors, this was the number kept.

The pattern revealed in Table 11 shows reasonable correspondence with the design of the instrument and good stability of the test over time. The only serious problem is the fractionation of the English clusters into a Writing singlet and a Reading and Literature primary loading on the Social Studies factor, but these may not be unexpected on content grounds. The Mathematics clusters form one clean factor and the Science clusters form another. The correlations among the factors are not excessive, indicating reasonable separation of the subject areas.

Discussion

It has been noted elsewhere (Council of Presidents, 1989) that college level assessment measures such as the Academic Profile, College Outcome Measures Program, and Collegiate Assessment of Academic Proficiency are high quality instruments with good reliability but that they add little to information that is available from other sources such as college admissions tests and grades. The present results indicate that the same conclusions apply to the College Basic Academic Subjects Exam.

The 18-month test-retest reliabilities, particularly of the subject, cluster, competency, and composite scores, are very satisfactory. In fact, they may be too high for an instrument that might be used to measure growth as a result of academic experience. Stability coefficients in the 70s and 80s over this period indicate highly stable general characteristics of individuals, characteristics that are unlikely to be modified to a significant degree by collegiate academic experience. This conclusion is also supported by the high correlations with the Washington Precollege Test scores which, although they have a substantial achievement component, are still primarily academic aptitude measures. The relevant CBASE scores correlate just

about as highly with the WPCT over 36 months as they do with themselves over 18 months. If general academic aptitude were partialled out of the CBASE scores, the correlations among them would be very low, indicating that the test is a reliable measure of little other than what is measured by the WPCT. (It should be noted that the WPCT, which is no longer being published, was more achievement oriented than the SAT and perhaps more so than the ACT.)

Correlations provide interesting and useful information about an instrument, but they do not address the issue of assessing change very well. At the program or institution level this is most directly a matter of what happens to the mean scores. In the present study the CBASE subject scores showed growth in all areas and the cluster scores showed growth in most, the only exceptions being a small loss in algebra and a larger loss in writing. However, it is the standard deviations of the change scores that are most alarming. They indicate, and this is confirmed by the frequency distributions, that on each scale over 40 percent of subjects showed losses. While a few small losses might be expected due to regression effects, there were a number of subjects who lost over 30 points (about one-half standard deviation).

It is hard to argue that exposure to a college education will result in a loss of knowledge, particularly on a test explicitly designed to assess gains due to that education, so we must look for some other explanation. The most obvious reason why students would get lower scores on the retest is that they did not take the task seriously. First-term freshmen are often compliant. When told to do their best on some task, they are likely to put out a reasonable effort. By the time they have been jaded by two years of college they are less likely to work hard at a task like the CBASE unless they have a personal stake in the outcome. Very few assessment measures are used in such a way that the students' scores will affect them in a meaningful way. Some, perhaps most, will take the task seriously and make an honest effort to get a good score. But our results indicate that a substantial number will do only what is necessary to complete the task in the minimum time.

If assessment results were to be used on the local campus only, and then only for program improvement, the presence of even a moderately large number of inaccurate test results would not be a problem. Unfortunately, when test results are used by external policy makers, particularly when they are used to compare institutions to provide a basis for funding, even a small number of seriously inaccurate test results can have significant adverse effects. This problem was also noted by Council of Presidents (1989), but the present study extends the demonstration of the problem to the analysis of growth. Thus, to the traditional problems associated with growth scores, negative correlations with initial status and the inherent unreliability of difference scores, must be added the problem of changes in student motivation.

References

Astin, A. W. (1985) Achieving educational excellence: A critical assessment of priorities and practices in higher education. San Francisco: Josey-Bass.

Banta, T. W. & Fisher, H. S. (1987). Putting a premium on results. Educational Record, 67, 57-69.

Banta, T. W., Lambert, E. W., Pike, G. R., Schmidhammer, J. L., & Schneider, J. A. (1987). Estimating student gains on the ACT COMP exam: Valid tool for institutional assessment? Review of Higher Education, 27 195-217.

Council of Presidents and State Board for Community College Education. (1989, September). The validity and usefulness of three nation standardized tests for measuring the communication, computation, and critical thinking skills of Washington State college sophomores: Technical report. Bellingham, WA: Western Washington University Office of Publications.

Osterlind, S. J. (1989). College BASE guide to test content. Chicago: The Riverside Publishing Company.

Parker, J. M., and Thorndike, R. M. (1989). Effects of age and education on cognitive development. Annual Meeting of the American Educational Research Association. San Francisco.

Thorndike, R. M., Andrieu-Parker, J. M. & Kube, B. Impact of life experiences on cognitive development. Annual Meeting of the American Educational Research Association. Boston.

Table 1

Variables Included in the Study

and Their Abbreviations

Abbreviation	Variable Name
CBASE Scores[a]	
Subject1	English Subject Score
Cluster11	Reading and Literature Cluster Score
Cluster12	Writing Cluster Score
Subject2	Mathematics Subject Score
Cluster21	General Mathematics Cluster Score
Cluster22	Algebra Cluster Score
Cluster23	Geometry Cluster Score
Subject3	Science Subject Score
Cluster31	Laboratory and Fieldwork Cluster Score
Cluster32	Fundamental Concepts Cluster Score
Subject4	Social Studies Subject Score
Cluster41	History Cluster Score
Cluster42	Social Sciences Cluster Score
Washington Precollege Scores	
WPCT1	Overall Composite Score
WPCT2	Verbal Composite Score
WPCT3	Quantitative Composite Score
WPCT4	Reading Comprehension Score
WPCT5	Vocabulary Score
WPCT6	English Usage Score
WPCT7	Spelling Score
WPCT8	Applied Mathematics Score
WPCT9	Mathematics Achievement Score
HSGPA	High School Grade Point Average (4 point scale)
WWUGPA	Grade Point Average through the end of Winter Quarter of 1990

[a]These abbreviations may be further abbreviated in some tables due to space restrictions. A letter R at the end of an abbreviation indicates a retest variable.

Table 2

Mean Pretest, Posttest, and Change Scores

and SD of Changes for 135 Students

Tested on Both Occasions

Score	Mean Pretest	Mean Posttest	Mean Change	SD Change
English	293.7	306.3	12.7	44.4
Reading	289.9	306.2	15.9	53.6
Writing	329.2	305.9	-23.3	36.6
Mathematics	324.4	332.6	8.2	43.5
Gen math	285.5	305.9	29.4	55.1
Algebra	333.5	331.6	-1.9	46.7
Geometry	335.1	337.6	2.5	44.2
Science	306.3	323.2	16.7	56.8
Lab work	298.4	317.2	18.8	56.9
Fundament	316.0	318.8	2.8	55.9
Social Studies	291.6	326.3	34.7	44.6
History	292.0	322.8	30.8	40.5
Soc Sci	293.0	320.9	27.9	44.0

Table 3

Correlations Among Pretest Subject and Cluster Scores

Pretest CBASE Variables

	SUBJT1	CLUS11	CLUS12	SUBJT2	CLUS21	CLUS22	CLUS23	SUBJT3	CLUS31	CLUS32
SUBJECT1	1.00	.92**	.53**	.43**	.50**	.28**	.31**	.51**	.44**	.46**
CLUSTR11	.92**	1.00	.31**	.33**	.44**	.21*	.21*	.47**	.39**	.45**
CLUSTR12	.53**	.31**	1.00	.36**	.30**	.33**	.27**	.33**	.31**	.22*
SUBJECT2	.43**	.33**	.36**	1.00	.80**	.83**	.78**	.50**	.44**	.43**
CLUSTR21	.50**	.44**	.30**	.80**	1.00	.47**	.54**	.54**	.47**	.50**
CLUSTR22	.28**	.21*	.33**	.83**	.47**	1.00	.50**	.22*	.20*	.14
CLUSTR23	.31**	.21*	.27**	.78**	.54**	.50**	1.00	.53**	.47**	.48**
SUBJECT3	.51**	.47**	.33**	.50**	.54**	.22*	.53**	1.00	.93**	.82**
CLUSTR31	.44**	.39**	.31**	.44**	.47**	.20*	.47**	.93**	1.00	.56**
CLUSTR32	.46**	.45**	.22*	.43**	.50**	.14	.48**	.82**	.56**	1.00
SUBJECT4	.55**	.56**	.21*	.33**	.38**	.14	.34**	.57**	.51**	.51**
CLUSTR41	.49**	.51**	.17	.29**	.31**	.11	.31**	.54**	.47**	.48**
CLUSTR42	.54**	.54**	.25*	.34**	.41**	.15	.32**	.52**	.47**	.45**
COMPETE1	.48**	.40**	.37**	.90**	.62**	.87**	.71**	.56**	.51**	.45**
COMPETE2	.70**	.59**	.48**	.79**	.83**	.47**	.67**	.76**	.69**	.62**
COMPETE3	.56**	.56**	.26**	.42**	.53**	.15	.36**	.63**	.64**	.45**
COMPOSIT	.79**	.72**	.45**	.71**	.70**	.45**	.62**	.83**	.75**	.71**

(Correlations continued)

	SUBJT3	CLUS41	CLUS42	COMP1	COMP2	COMP3	COMPOS
SUBJECT1	.55**	.49**	.54**	.48**	.70**	.56**	.79**
CLUSTR11	.56**	.51**	.54**	.40**	.59**	.56**	.72**
CLUSTR12	.21*	.17	.25*	.37**	.48**	.26**	.45**
SUBJECT2	.33**	.29**	.34**	.90**	.79**	.42**	.71**
CLUSTR21	.38**	.31**	.41**	.62**	.83**	.53**	.70**
CLUSTR22	.14	.11	.15	.87**	.47**	.15	.45**
CLUSTR23	.34**	.31**	.32**	.71**	.67**	.36**	.62**
SUBJECT3	.57**	.54**	.52**	.56**	.76**	.63**	.83**
CLUSTR31	.51**	.47**	.47**	.51**	.69**	.64**	.75**
CLUSTR32	.51**	.48**	.45**	.45**	.62**	.45**	.71**
SUBJECT4	1.00	.94**	.89**	.41**	.55**	.65**	.79**
CLUSTR41	.94**	1.00	.69**	.37**	.50**	.57**	.73**
CLUSTR42	.89**	.69**	1.00	.40**	.53**	.64**	.73**
COMPETE1	.41**	.37**	.40**	1.00	.68**	.36**	.74**
COMPETE2	.55**	.50**	.53**	.68**	1.00	.63**	.89**
COMPETE3	.65**	.57**	.64**	.36**	.63**	1.00	.73**
COMPOSIT	.79**	.73**	.73**	.74**	.89**	.73**	1.00

Table 4

Correlations Among Posttest Subject and Cluster Scores

Posttest CBASE Variables

	SUBJ1R	CLU11R	CLU12R	SUBJ2R	CLU21R	CLU22R	CLU23R	SUBJ3R	CLU31R	CLU32R
SUBJEC1R	1.00	.89**	.76**	.26**	.30**	.16	.17	.46**	.41**	.42**
CLUST11R	.89**	1.00	.33**	.24*	.30**	.13	.18	.53**	.49**	.46**
CLUST12R	.76**	.33**	1.00	.22*	.21*	.14	.16	.24*	.22*	.22*
SUBJEC2R	.26**	.24*	.22*	1.00	.79**	.84**	.83**	.47**	.51**	.30**
CLUST21R	.30**	.30**	.21*	.79**	1.00	.44**	.55**	.52**	.55**	.36**
CLUST22R	.16	.13	.14	.84**	.44**	1.00	.61**	.25*	.29**	.12
CLUST23R	.17	.18	.16	.83**	.55**	.61**	1.00	.44**	.48**	.28**
SUBJEC3R	.46**	.53**	.24*	.47**	.52**	.25*	.44**	1.00	.95**	.85**
CLUST31R	.41**	.49**	.22*	.51**	.55**	.29**	.48**	.95**	1.00	.66**
CLUST32R	.42**	.46**	.22*	.30**	.36**	.12	.28**	.85**	.66**	1.00
SUBJEC4R	.59**	.65**	.23*	.34**	.41**	.18	.26*	.61**	.54**	.56**
CLUST41R	.52**	.60**	.17	.28**	.32**	.18	.18	.51**	.45**	.47**
CLUST42R	.57**	.61**	.26*	.37**	.46**	.16	.32**	.64**	.58**	.58**
COMPETR1	.40**	.34**	.30**	.92**	.58**	.92**	.76**	.46**	.50**	.31**
COMPETR2	.65**	.58**	.45**	.76**	.80**	.46**	.64**	.78**	.78**	.59**
COMPETR3	.71**	.72**	.36**	.39**	.47**	.21*	.32**	.77**	.76**	.62**
COMPOSTR	.76**	.73**	.47**	.67**	.66**	.45**	.56**	.85**	.82**	.72**

(Correlations continued)

	SUBJ4R	CLU41R	CLU42R	COMPR1	COMPR2	COMPR3	COMPOSR
SUBJEC1R	.59**	.52**	.57**	.40**	.65**	.71**	.76**
CLUST11R	.65**	.60**	.61**	.34**	.58**	.72**	.73**
CLUST12R	.23*	.17	.26*	.30**	.45**	.36**	.47**
SUBJEC2R	.34**	.28**	.37**	.92**	.76**	.39**	.67**
CLUST21R	.41**	.32**	.46**	.58**	.80**	.47**	.66**
CLUST22R	.18	.18	.16	.92**	.46**	.21*	.45**
CLUST23R	.26*	.18	.32**	.76**	.64**	.32**	.56**
SUBJEC3R	.61**	.51**	.64**	.46**	.78**	.77**	.85**
CLUST31R	.54**	.45**	.58**	.50**	.78**	.76**	.82**
CLUST32R	.56**	.47**	.58**	.31**	.59**	.62**	.72**
SUBJEC4R	1.00	.94**	.91**	.37**	.66**	.68**	.82**
CLUST41R	.94**	1.00	.72**	.34**	.56**	.56**	.73**
CLUST42R	.91**	.72**	1.00	.37**	.68**	.71**	.80**
COMPETR1	.37**	.34**	.37**	1.00	.65**	.40**	.68**
COMPETR2	.66**	.56**	.68**	.65**	1.00	.70**	.91**
COMPETR3	.68**	.56**	.71**	.40**	.70**	1.00	.82**
COMPOSTR	.82**	.73**	.80**	.68**	.91**	.82**	1.00

Table 5

Correlations of Pretest Scores
with Posttest Scores

Posttest CBASE Variables	Pretest CBASE Variables								
	SUBJT1	CLUS11	CLUS12	SUBJT2	CLUS21	CLUS22	CLUS23	SUBJT3	CLUS31	CLUS32
SUBJEC1R	.69**	.60**	.42**	.40**	.41**	.27**	.29**	.48**	.44**	.36**
CLUST11R	.61**	.60**	.16	.26*	.36**	.04	.26*	.48**	.43**	.42**
CLUST12R	.52**	.38**	.58**	.41**	.34**	.41**	.24*	.29**	.28**	.17
SUBJEC2R	.29**	.22*	.25*	.72**	.56**	.54**	.66**	.48**	.48**	.35**
CLUST21R	.36**	.29**	.27**	.61**	.54**	.39**	.58**	.51**	.51**	.37**
CLUST22R	.16	.10	.18	.49**	.35**	.43**	.41**	.25*	.27**	.15
CLUST23R	.21*	.16	.19	.64**	.48**	.47**	.65**	.45**	.44**	.35**
SUBJEC3R	.53**	.47**	.32**	.45**	.45**	.22*	.50**	.67**	.64**	.51**
CLUST31R	.50**	.43**	.31**	.44**	.45**	.21*	.50**	.64**	.63**	.46**
CLUST32R	.46**	.41**	.27**	.35**	.33**	.18	.41**	.54**	.49**	.46**
SUBJEC4R	.60**	.63**	.20*	.31**	.34**	.14	.35**	.53**	.43**	.53**
CLUST41R	.56**	.59**	.16	.27**	.28**	.12	.29**	.46**	.34**	.52**
CLUST42R	.55**	.57**	.23*	.33**	.35**	.14	.39**	.52**	.47**	.46**
COMPETR1	.32**	.25*	.28**	.64**	.48**	.52**	.55**	.44**	.44**	.32**
COMPETR2	.64**	.56**	.36**	.69**	.64**	.44**	.64**	.67**	.65**	.52**
COMPETR3	.58**	.55**	.32**	.32**	.38**	.10	.36**	.57**	.57**	.39**
COMPOSTR	.68**	.63**	.38**	.60**	.57**	.36**	.59**	.70**	.65**	.58**

(Correlations continued)

	SUBJT4	CLUS41	CLUS42	COMP1	COMP2	COMP3	COMPOS
SUBJEC1R	.53**	.47**	.52**	.42**	.57**	.57**	.66**
CLUST11R	.60**	.55**	.55**	.27**	.48**	.61**	.62**
CLUST12R	.21*	.15	.26**	.40**	.47**	.30**	.45**
SUBJEC2R	.31**	.27**	.31**	.66**	.61**	.39**	.57**
CLUST21R	.38**	.31**	.41**	.56**	.63**	.44**	.59**
CLUST22R	.16	.15	.14	.46**	.36**	.23*	.34**
CLUST23R	.23*	.20*	.22*	.60**	.51**	.30**	.48**
SUBJEC3R	.46**	.44**	.41**	.44**	.66**	.52**	.68**
CLUST31R	.41**	.38**	.36**	.43**	.64**	.49**	.64**
CLUST32R	.41**	.39**	.37**	.36**	.52**	.43**	.57**
SUBJEC4R	.79**	.75**	.69**	.39**	.52**	.54**	.72**
CLUST41R	.75**	.75**	.61**	.36**	.43**	.46**	.65**
CLUST42R	.70**	.62**	.68**	.37**	.54**	.53**	.68**
COMPETR1	.33**	.29**	.32**	.63**	.53**	.38**	.55**
COMPETR2	.57**	.52**	.54**	.66**	.81**	.59**	.82**
COMPETR3	.59**	.55**	.52**	.33**	.59**	.63**	.66**
COMPOSTR	.68**	.63**	.63**	.62**	.76**	.66**	.85**

Table 6

Correlations of Pretest scores
with Demographic Variables

Pretest CBASE Variables

	SUBJ1	CLS11	CLS12	SUBJ2	CLS21	CLS22	CLS23	SUBJ3	CLS31	CLS32
HSGPA	.33**	.24*	.41**	.38**	.32**	.35**	.29**	.40**	.36**	.34**
WWUGPA	.46**	.47**	.32**	.37**	.36**	.20*	.36**	.45**	.42**	.35**
WPCT1	.54**	.45**	.47**	.49**	.41**	.41**	.38**	.57**	.53**	.45**
WPCT2	.77**	.69**	.50**	.41**	.48**	.22*	.32**	.57**	.51**	.48**
WPCT3	.50**	.45**	.33**	.63**	.55**	.42**	.58**	.54**	.50**	.46**
WPCT4	.64**	.62**	.27**	.35**	.45**	.14	.30**	.54**	.48**	.46**
WPCT5	.65**	.62**	.36**	.30**	.42**	.06	.28**	.56**	.48**	.53**
WPCT6	.68**	.53**	.50**	.41**	.44**	.27**	.28**	.41**	.39**	.30**
WPCT7	.49**	.38**	.47**	.27**	.21*	.25*	.17	.25*	.23*	.18
WPCT8	.52**	.50**	.31**	.53**	.51**	.33**	.47**	.49**	.43**	.44**
WPCT9	.37**	.30**	.29**	.60**	.48**	.42**	.58**	.48**	.47**	.38**

	SUB4	CLU41	CLU42	COMP1	COMP2	COMP3	COMPOS
HSGPA	.24*	.19	.25*	.40**	.42**	.32**	.43**
WWUGPA	.41**	.37**	.40**	.37**	.50**	.46**	.54**
WPCT1	.41**	.37**	.40**	.54**	.58**	.50**	.64**
WPCT2	.59**	.53**	.57**	.43**	.67**	.61**	.74**
WPCT3	.49**	.45**	.46**	.61**	.67**	.46**	.68**
WPCT4	.58**	.51**	.58**	.37**	.58**	.60**	.67**
WPCT5	.61**	.55**	.58**	.32**	.59**	.55**	.68**
WPCT6	.42**	.39**	.38**	.40**	.59**	.43**	.60**
WPCT7	.22*	.19	.22*	.28**	.37**	.32**	.39**
WPCT8	.47**	.42**	.45**	.50**	.65**	.43**	.64**
WPCT9	.42**	.38**	.39**	.60**	.55**	.39**	.59**

Table 7

Correlations of Posttest Scores
with Demographic Variables

Posttest CBASE Variables

	SUB1R	CL11R	CL12R	SUB2R	CL21R	CL22R	CL23R	SUB3R	CL31R	CL32R
HSGPA	.32**	.17	.40**	.46**	.32**	.41**	.39**	.30**	.28**	.26**
WWUGPA	.42**	.35**	.35**	.38**	.39**	.21*	.30**	.51**	.51**	.38**
WPCT1	.49**	.37**	.47**	.53**	.47**	.41**	.44**	.48**	.47**	.39**
WPCT2	.70**	.65**	.49**	.30**	.42**	.16	.17	.56**	.54**	.45**
WPCT3	.39**	.34**	.30**	.63**	.66**	.43**	.49**	.55**	.57**	.38**
WPCT4	.56**	.57**	.32**	.21*	.35**	.03	.13	.50**	.48**	.39**
WPCT5	.59**	.64**	.31**	.23*	.35**	.09	.14	.56**	.52**	.46**
WPCT6	.59**	.49**	.49**	.30**	.36**	.20*	.19	.43**	.44**	.30**
WPCT7	.48**	.32**	.44**	.21*	.25*	.19	.09	.28**	.26*	.25*
WPCT8	.43**	.39**	.31**	.49**	.55**	.30**	.38**	.53**	.54**	.37**
WPCT9	.26*	.21*	.22*	.65**	.63**	.48**	.50**	.46**	.49**	.31**

	SUB4R	CL41R	CL42R	COMR1	COMR2	COMR3	COMPOSR
HSGPA	.26*	.25*	.22*	.48**	.40**	.24*	.42**
WWUGPA	.49**	.44**	.49**	.37**	.54**	.53**	.58**
WPCT1	.45**	.42**	.40**	.55**	.59**	.44**	.63**
WPCT2	.57**	.51**	.54**	.32**	.64**	.68**	.69**
WPCT3	.51**	.43**	.52**	.57**	.71**	.53**	.67**
WPCT4	.56**	.48**	.56**	.19	.56**	.61**	.60**
WPCT5	.58**	.51**	.55**	.27**	.56**	.64**	.64**
WPCT6	.41**	.38**	.36**	.30**	.56**	.52**	.56**
WPCT7	.23*	.21*	.21*	.23*	.35**	.38**	.38**
WPCT8	.51**	.41**	.53**	.44**	.66**	.57**	.64**
WPCT9	.41**	.35**	.41**	.59**	.62**	.38**	.58**

Table 9

Correlations of Pretest Scores
with Changes

Change in Subject or Cluster Score

	SU1C	CL11C	CL12C	SU2C	CL21C	CL22C	CL23C	SU3C	CL31C	CL32C
SUBJECT1	-.41**	-.30**	.17	-.18	-.14	-.13	-.11	.05	.07	.01
CLUSTR11	-.41**	-.39**	.18	-.14	-.14	-.11	-.05	.03	.06	-.02
CLUSTR12	-.15	-.14	-.15	-.14	-.02	-.16	-.08	.01	.02	.04
SUBJECT2	-.05	-.06	.19	-.36**	-.18	-.37**	-.15	-.03	.01	-.07
CLUSTR21	-.12	-.06	.15	-.31**	-.45**	-.14	-.06	-.08	-.00	-.16
CLUSTR22	-.02	-.17	.20*	-.38**	-.06	-.59**	-.02	.01	.01	.03
CLUSTR23	-.03	.06	.05	-.16	.05	-.12	-.39**	-.00	.04	-.06
SUBJECT3	-.05	.04	.06	-.02	-.02	.00	-.08	-.35**	-.32**	-.24*
CLUSTR31	-.00	.07	.07	.05	.05	.04	-.02	-.31**	-.40**	-.06
CLUSTR32	-.13	-.00	.01	-.09	-.11	-.01	-.14	-.33**	-.11	-.49**
SUBJECT4	-.04	.07	.07	-.02	.00	.00	-.12	-.10	-.10	-.07
CLUSTR41	-.04	.08	.04	-.02	.01	.02	-.12	-.09	-.08	-.08
CLUSTR42	-.03	.04	.10	-.03	.00	-.02	-.11	-.10	-.11	-.07
COMPETE1	-.08	-.11	.17	-.32**	-.05	-.44**	-.10	-.10	-.08	-.08
COMPETE2	-.17	-.08	.16	-.23*	-.18	-.14	-.18	-.08	-.04	-.09
COMPETE3	-.00	.09	.13	-.03	-.08	.05	-.07	-.11	-.16	-.01
COMPOSIT	-.17	-.06	.15	-.19	-.10	-.14	-.15	-.15	-.11	-.13

	SU4C	CL41C	CL42C	COM1C	COM2C	COM3C	COMPCH
SUBJECT1	.12	.08	.07	-.17	.02	.10	-.17
CLUSTR11	.14	.11	.08	-.16	.05	.05	-.17
CLUSTR12	.02	-.00	.01	-.07	-.09	.12	-.10
SUBJECT2	.00	-.02	.02	-.30**	-.02	-.04	-.18
CLUSTR21	-.03	-.04	-.02	-.17	-.16	-.09	-.24*
CLUSTR22	.03	.03	.00	-.39**	.03	-.01	-.14
CLUSTR23	.04	-.04	.12	-.19	.08	.05	-.06
SUBJECT3	-.02	-.12	.05	-.13	-.00	.00	-.24*
CLUSTR31	-.08	-.19	.04	-.06	.05	.00	-.18
CLUSTR32	.06	.03	.03	-.17	-.06	-.02	-.26**
SUBJECT4	-.26*	-.29**	-.16	-.08	.14	.01	-.19
CLUSTR41	-.23*	-.37**	-.03	-.08	.13	.06	-.17
CLUSTR42	-.24*	-.13	-.32**	-.08	.13	-.04	-.18
COMPETE1	.01	-.01	.00	-.41**	.08	.02	-.22*
COMPETE2	-.01	-.10	.06	-.17	-.12	.05	-.22*
COMPETE3	-.12	-.15	-.07	.03	.07	-.30**	-.12
COMPOSIT	-.05	-.12	-.00	-.21*	.04	.02	-.25*

Table 9

Correlations of Posttest Scores
with Changes

	Change in Subject or Cluster Score								
	SU1C	CL11C	CL12C	SU2C	CL21C	CL22C	CL23C	SU3C	CL31C	CL32C
SUBJEC1R	.36**	.33**	.56**	-.18	-.11	-.12	-.13	.00	-.02	.07
CLUST11R	.26**	.48**	.24*	-.01	-.05	.08	-.08	.08	.08	.05
CLUST12R	.29**	-.03	.70**	-.25*	-.13	-.27**	-.09	-.03	-.05	.04
SUBJEC2R	-.04	.03	.05	.37**	.24*	.21*	.23*	.01	.04	-.04
CLUST21R	-.07	.01	.02	.23*	.49**	.00	-.02	.04	.06	-.00
CLUST22R	-.00	.04	.01	.46**	.10	.46**	.25*	.00	.02	-.01
CLUST23R	-.04	.02	.02	.26**	.08	.08	.43**	.01	.06	-.05
SUBJEC3R	-.10	.08	.01	.02	.08	.00	-.06	.45**	.36**	.34*
CLUST31R	-.11	.07	-.00	.09	.11	.05	-.00	.42**	.44**	.20*
CLUST32R	-.05	.08	.03	-.06	.04	-.06	-.13	.41**	.20*	.53*
SUBJEC4R	-.09	.05	.08	.04	.08	.02	-.10	.12	.14	.04
CLUST41R	-.11	.04	.05	.02	.05	.04	-.12	.08	.13	-.03
CLUST42R	-.05	.07	.09	.05	.12	.01	-.08	.17	.14	.13
COMPETR1	.05	.11	.10	.40**	.12	.33**	.26**	.05	.07	.00
COMPETR2	-.06	.05	.20*	.11	.19	-.00	.00	.17	.17	.07
COMPETR3	.07	.23*	.13	.09	.10	.09	-.04	.28**	.24*	.23*
COMPOSTR	.00	.15	.20*	.10	.11	.05	-.01	.22*	.21*	.14

	SU4C	CL41C	CL42C	COM1C	COM2C	COM3C	COMPCH
SUBJEC1R	.10	.05	.09	.02	.20*	.22*	.16
CLUST11R	.11	.04	.11	.07	.24*	.21*	.19
CLUST12R	.06	.04	.03	-.05	.03	.13	.05
SUBJEC2R	.05	-.00	.09	.27**	.36**	.04	.17
CLUST21R	.07	-.00	.11	.00	.41**	.10	.12
CLUST22R	.03	.02	.03	.52**	.24*	.01	.21*
CLUST23R	.04	-.04	.12	.13	.31**	.05	.11
SUBJEC3R *	.24*	.07	.31**	-.00	.31**	.37**	.30**
CLUST31R	.21*	.05	.30**	.03	.34**	.38**	.30**
CLUST32R *	.26*	.10	.30**	-.05	.21*	.29**	.28**
SUBJEC4R	.38**	.24*	.33**	-.01	.34**	.24*	.19
CLUST41R	.35**	.32**	.20*	-.02	.30**	.18	.14
CLUST42R	.37**	.13	.47**	-.00	.35**	.30**	.24*
COMPETR1	.09	.05	.09	.43**	.30**	.07	.25*
COMPETR2	.17	.04	.22*	-.00	.46**	.21*	.18
COMPETR3	.18	.00	.29**	.08	.29**	.53**	.29**
COMPOSTR	.26*	.12	.28**	.08	.39**	.29**	.27**

Table

Squared Multiple Correlations and Eigenvalues
for Pretest and Posttest Clusters

Variable	SMC	Factor	Eigenvalue
CLUST11R	.58787	1	7.53935
CLUST12R	.50469	2	2.38034
CLUST21R	.54682	3	1.43144
CLUST22R	.46257	4	1.00553
CLUST23R	.62809	5	.76749
CLUST31R	.67314	6	.64603
CLUST32R	.53917	7	.63813
CLUST41R	.75920	8	.56685
CLUST42R	.72495	9	.48027
CLUSTR11	.57010		
CLUSTR12	.42769		
CLUSTR21	.55145		
CLUSTR22	.52017		
CLUSTR23	.61306		
CLUSTR31	.60459		
CLUSTR32	.56553		
CLUSTR41	.69071		
CLUSTR42	.64284		

Table 11

Oblique Four-Factor Solution for
Pretest and Posttest Cluster Scores

	Factors				
	FAC 1	FAC 2	FAC 3	FAC 4	Communality
CLUSTR11	.586				.368
CLUST11R	.585				.360
CLUSTR12			.599		.433
CLUST12R			.884		.776
CLUSTR21		.459			.307
CLUST21R		.551			.552
CLUSTR22		.633	.334		.555
CLUST22R		.690			.436
CLUSTR23		.649			.624
CLUST23R		.814			.717
CLUSTR31				.495	.546
CLUST31R				.807	.783
CLUSTR32	.361			.314	.455
CLUST32R				.622	.549
CLUSTR41	.893				.706
CLUST41R	.904				.752
CLUSTR42	.787				.633
CLUST42R	.649				.696

Factor Correlation Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
FACTOR 1	1.000			
FACTOR 2	.287	1.000		
FACTOR 3	.303	.327	1.000	
FACTOR 4	.582	.385	.245	1.000